

REMARKS

Claims 25 - 44 are pending in this application. Claims 25, 35-41 and 43 have been amended. A Request for Continued Examination is filed herewith in an effort to resolve remaining issues without resort to appeal. Reconsideration and allowance are requested in view of the amendments and the following remarks.

Applicants' invention is drawn to an apparatus for *identification of a marked liquid*. The apparatus includes a detector and a concentration pattern comparison element. The apparatus performs an analysis on liquids which include *at least two markers*, wherein each of the markers is miscible with the liquid and wherein each of the markers has a *unique optical detection spectrum* that is differentiable from the spectra of the liquid and any other marker in the liquid. The *concentrations of the markers are preselected* to identify the liquid, such that *a set of concentration patterns is predefined*. The detector identifies the markers by their respective absorption spectra and *generates signals indicative of relative concentrations of the markers* in the liquid. The comparison element compares the signals from the detector (e.g., the measured concentrations of a first and second markers) with a *look up table of the predetermined concentration patterns* to identify the liquid.

In one preferred embodiment, the invention is useful in identifying the source (or tax status) of petroleum products. The liquid petroleum is marked by adding at least a first marker and a second marker, each of which has an unique detection spectrum that is differentiable from that of the liquid and any other marker in the liquid. The markers are added in predefined amounts such that the ratio of the concentration of the first marker to the concentration of the second marker substantially equals a predetermined value. The apparatus detected this value (e.g. a concentration pattern) and compares the measured value with a look-up table of known patterns to identify the liquid. The invention not only permits precise identification of petroleum products but does so without the need for a large number of distinct markers. By utilizing a "code" of *relative concentrations*, a large number of unique signatures can be established with a small set of markers.

Prior Art Rejections

All of the claims stand rejected as either anticipated under 35 U.S.C. 102 or obvious under 35 U.S.C. 103 in view of U.S. Patent No. 5,742,064 (“Infante”) or U.S. Patent 5,792,610 (“Witney *et al.*”). Applicants respectfully disagree.

The Infante reference discloses an apparatus for detecting “impurities” in liquids by analyzing the absorption and/or fluorescence spectra of the liquid. Although Infante also mentions that his technique can be used to detect a “batch marker substance,” Infante does not appreciate the problem solved by the applicants, namely, the need for an apparatus that can uniquely identify a large number of different liquids without resort to a vast number of markers. Because Infante does not appreciate the problem, it can not be said that he anticipates (or even suggests) the use of a detector that measures the *relative concentrations of a plurality of markers* together with a comparison element that *compares measured concentration patterns with a look-up table of predefined “signature” patterns*.

The Witney *et al.* reference likewise does not detract from the present invention. Witney *et al.* are concerned with the identification of nucleic acid strands. They teach the use of fluorescent labels on complementary strands (“probes”) as a way of determining if the desired DNA is present in an immobilized sample. If the fluorescent “probe” comes into contact with an immobilized matching strand of DNA, they will bind together and the fluorescent probe will remain bound to the sample, thus signaling the presence of a particular nucleic acid sequence. If Witney’s technique were to be extrapolated to petroleum identification, it would require not just one vast library of markers, but also a second, complementary library of fluorescent labeled markers capable of binding one-to-one with the members of the first family of markers!

The amendments to the claims are submitted to clarify the invention. In particular, claim 25 has been amended to specify that Applicants’ apparatus is an apparatus for assisting in the identification of a marked liquid that has a “*plurality of markers* miscible with the liquid and present in a *predetermined pattern of relative concentrations....*” Moreover, the apparatus further includes a detector element for “*detecting the plurality of markers and for generating signals indicative of relative concentrations of each....*” Finally, claim 25 now specifies that the apparatus

further comprises a comparison element that compares the *measured concentration pattern* with *known marker concentration patterns* of identified liquids, via a look up table, to identify of the marked liquid.

A Request for Continued Examination, together with the necessary fee, is filed herewith in an effort to resolve remaining issues without resort to appeal. An request for a one month extension of time is also submitted herewith, together with the necessary fee. In the event that any additional fees are necessary, please charge deposit account 141449.

CONCLUSION

Early reconsideration is requested. In the event that after entry, the amended claims are not deemed to be in condition for allowance, an interview with the Examiner is requested. If the Examiner believes that an interview would facilitate the resolution of any outstanding issues, he is kindly requested to contact the undersigned.

Dated: 27 August 2001

Respectfully submitted,

By: 

Thomas J. Engellenner
Reg. No. 28,711
Attorney for Applicant(s)

NUTTER, McCLENNEN & FISH, LLP
One International Place
Boston, MA 02110-2699
Telephone: (617) 439-2948
Facsimile: (617) 310-9948

“Version with markings to show changes made.”

25. (Twice Amended) An apparatus for assisting in the identification of a marked liquid, the liquid comprising a plurality of markers miscible with the liquid and present in a predetermined pattern of relative concentrations, the apparatus comprising:

[(a) a vessel for receiving a liquid including at least a first marker and a second marker, wherein each of said markers is miscible with said liquid and wherein each of said markers has a unique absorption spectrum differentiable from the absorption spectrum of said liquid and any other marker in said liquid;

(b)] a detector for [identifying said first marker and said second marker by their respective absorption spectra] detecting the plurality of markers and for generating signals indicative of relative concentrations of each of the [first and second marker in the liquid, the concentrations of the] markers [having been preselected to identify the liquid], the signals defining a measured concentration pattern; and

[(c)] a pattern comparison element [to compare said detector signals with a look up table of] capable of comparing the measured concentration pattern with known [predetermined] marker concentration patterns[, the concentration patterns being chosen as unique indicators for specific liquids that carry said markers, so as to assist in identification of said liquid] of identified liquids, the [predetermined] known patterns being accessible, via a look up table, to the pattern comparison element, so as to assist in the identification of the marked liquid.

35. (Amended) The apparatus of claim 25, wherein said detector is limited to those portions of the electromagnetic spectrum associated with select vibrational mode signatures characteristic of said [first and second] plurality of markers.

36. (Amended) The apparatus of claim 25, further comprising at least [a second] one additional detector, wherein [said first] the detector is limited to that portion of the electromagnetic spectrum associated with a select vibrational mode signature characteristic of [said] a first marker and wherein [said second] the at least one additional detector is limited to that portion of the

electromagnetic spectrum associated with a select vibrational mode signature characteristic of [said second] another of the plurality of markers [marker].

37. (Amended) The apparatus of claim 36, wherein [said first] the detector measures a nitrile vibration and [said second] the at least one additional detector measures an isotopically labeled carbon-nitrile vibration.

38. (Amended) The apparatus of claim 36, wherein [said first] the detector measures infrared absorption band of a nitrile vibration at 2230 cm^{-1} and [said second] the at least one additional detector measures an isotopically labeled carbon-nitrile infrared absorption band at 2140^{-1} cm .

39. (Amended) The apparatus of claim 36, wherein [said first] the detector measures a nitrile vibration and [said second] the at least one additional detector measures an isocyanate vibration.

40. (Amended) The apparatus of claim 36, wherein [said first] the detector measures infrared absorption band of a nitrile vibration at 2230 cm^{-1} and [said second] the at least one additional detector measures an isocyanate infrared absorption band at 2268^{-1} cm .

41. (Amended) The apparatus of claim 36, wherein [said first] the detector measures absorbance at a wavelength of 520 nm and [said second] the at least one additional detector measures absorbance at a wavelength of 550 nm.

43. (Amended) The apparatus of claim 25, wherein said comparison element further comprises a detector for determining the ratio of the concentration of [said] a first marker to the concentration of [said] a second marker.